This guide is available at http://www.cell.com/star-authors-guide and is aimed at authors publishing in a Cell Press journal other than *Cell*. If you are publishing in *Cell*, please use the *Cell* version available here. Please contact cpmethods@cell.com with any questions.

# STAR Methods guide for authors

**STAR Methods (structured, transparent, accessible reporting)**, used in our life sciences journals and *iScience*, is structured with four headings (in all caps below) and a key resources table that summarizes the critical materials and resources used in the manuscript. There is no character limit.

The section is typeset and included with the main text online and in the online PDF. It is, however, not copyedited. The print-only PDF will summarize the STAR Methods in an outline that is automatically generated from the section's headings and first-level subheadings. Authors do not need to submit the outline; it will be created by our production team and included with the page proofs for review.

The STAR Methods format is required for acceptance. It is not required for initial submission, but it is encouraged. For examples of the format, please refer to the most current issue of the journal to which you're submitting.

The STAR Methods guide includes three main components:

I. **General instructions** designed to assist authors as they prepare the STAR Methods text and key resources table.

II. A **final file checklist** that aims to clarify how an article's content should be organized when final files are uploaded to Editorial Manager.

III. The **STAR Methods reference sheet**, a checklist of key points that editors will check during the review of a manuscript.

## I. General instructions: STAR Methods text

The STAR Methods should be provided as a Word document, either with the main text or as a separate file. The section should be introduced after the figure legends if included in the main text file.

Please report your methods with sufficient detail so readers do not need to refer to other papers to understand how procedures were performed. Citations of previous publications are allowed but should not be used as a substitute for providing the details of a procedure.

References cited in the STAR Methods must be included in the main references list. Supplemental references should appear in a separate list in the supplemental PDF. References are not included in the manuscript character count limits.

Please note that the STAR Methods should not contain figures (aside from chemical reaction schemes) or tables that are complex or numbered. All other items should be included as part of the supplemental information. If you are unsure if an item can appear in the STAR Methods, please consult the journal's editorial team.

The STAR Methods text is organized into four standard headings. To specify the types of experiments and analyses used, authors are encouraged to further organize the text by adding up to two levels of subheadings under each heading.

Please note:

(1) The four standard headings and the first level of author-added subheadings are used to populate the outline of the STAR Methods that appears before the references in the article.

(2) Author-added subheadings should be clear and concise and are limited to 45 characters.

(3) Subheadings should not be numbered.

(4) Please format each level of subheading with a typeface that is different from the body text and the other subheadings.

## EXPERIMENTAL MODEL AND STUDY PARTICIPANT DETAILS

**Please omit this section if your study does not use experimental models typical in the life sciences (e.g., computational or physical science research). This section should include information related to cell lines/strains used for in vitro experiments.*

Please list here under separate headings all of the experimental models/study participants (animals, human participants, plants, microbe strains, cell lines, primary cell cultures) in the study. For each model, provide information related to their species, maintenance, and care. The influence (or association) of sex, gender, or both on the results of the study must be reported. In cases where it cannot, authors should discuss this as a limitation to their research's generalizability.

***For in vivo animal studies***, reporting of the sex and age/developmental stage of the animals is required. If there are technical or scientific reasons why sex and age/developmental stage cannot be reported, a statement must be provided to disclose this and the reasons why. We also ask authors to provide details recommended by ARRIVE guidelines. This includes the available and detailed information related to the species, strain and backcrossing status, developmental stage, weight, genotype, health/immune status, drug or test naive, previous procedures, housing, and husbandry. Please note here if the animals were kept under specific conditions (e.g., single/group housed, specific food, temperature, or cage conditions). Also, please describe here how animals were allocated to experimental groups (e.g., littermates of the same sex were randomly assigned to experimental groups). Studies that use live vertebrates must perform their work in accordance with relevant institutional and national guidelines and regulations, and it is required that authors identify the committee approving the experiments and confirming that all experiments conform to the relevant regulatory standards.

***For studies involving human participants***, the age/developmental stage, sex, gender, ancestry, race, ethnicity, and socioeconomic status of the participants must be provided. For sex and gender, researchers should consider which terms best describe their data and should refer to the information for authors under "Reporting sex- and gender-based analyses" for the provided definitional guidance. If there are technical or scientific reasons why the sex and/or gender of the subjects cannot be reported, a statement must be provided to disclose this and the reasons why. Additionally, authors should discuss the absence of sex- and gender-based analyses as a limitation to their research's generalizability. Please also provide information related to the participants (e.g., sample size) or indicate where in the manuscript such information can be found. Studies that work with human participants are required to provide a statement identifying the committee approving the studies and confirming that informed consent was obtained from all participants. For studies that use human samples as experimental source materials, please provide details on participant profile, sex, gender, age, etc.

***For studies involving human embryos or embryo models, gametes, and/or stem cells***, for research falling under categories 1b and 2, as defined by the ISSCR guidelines, authors must include an "ethics statement" noting that the research was performed after obtaining approval following a suitable research oversight process. The statement must contain explicit mention of compliance to principles laid out in the ISSCR 2021 guidelines, including which category the research falls under or any applicable equivalent regulations (e.g., HFEA in the UK); description of the research that underwent ethical review; details of gamete/embryo procurement and conditions of donation; details about informed consent, including whether the donor(s) were informed of the purpose of the research and specific procedures the tissue will be used for; and whether possible future use cases were discussed with the donor. If embryos were created from gametes for research purposes, this should be clearly noted along with whether donors were aware. For category 2 research, the name and affiliation of approving EMRO and/or committee(s) must be stated. Papers studying natural human embryos must include details as to how long human embryos were cultured and which important developmental landmarks were identified. For papers studying human embryo models, it must be noted whether the research involved integrated or non-integrated embryo models, how long they were cultured, and which important developmental landmarks were identified, along with whether community guidelines or ISSCR recommendations were considered when deciding on the nomenclature for models described in the study.

***For cell lines, primary cultures, and microbe strains***, please describe culture/growth conditions, including temperature. Sex of cells must also be reported. If this is not possible, a statement must be provided to disclose this and the reasons why. Please note any available information about cell authentication. As you may be aware, the practice of cell authentication is becoming more common, and while we understand that this is not yet a standard practice, we ask that you indicate whether your cell lines have been authenticated. If so, please describe how.

***For all experimental models***, we highly recommend including models' RRIDs in their description, as well as using the RRID as the identifier in the key resources table. For more information on how to obtain or generate an RRID for existing or newly generated resources, please visit the RII or search for RRIDs.

***For studies that use non-human organisms as experimental source materials*** (e.g., crystallography, biochemistry, *in vitro* studies), please provide details on the source organism (e.g., strain, growth/husbandry conditions, sex, age, etc.).

***For plants***, please describe growth conditions, including details of culture chamber makes and models, temperatures, times and light intensities of illumination, artificial lighting periods for greenhouses, substrate composition, fertilizer application regimes (if applicable), and humidity. For field-grown plants, please describe the location of the farm and growing season and years of the plants. Where applicable, please describe how seeds were surface sterilized, stratified, germinated, and vernalized, as well as details of solutions or media used for these steps, temperatures, and lengths of time.

## METHOD DETAILS

Please provide precise details of all the procedures in the paper (chemical synthesis and materials processing, behavioral task, generation of reagents, generation and characterization of transgenic organisms, biological assays, modeling, etc.) such that it is clear how, when, where, and why procedures were performed. We encourage authors to provide information related to the experimental design as suggested by NIH and ARRIVE guidelines (e.g., information about replicates, randomization, blinding, sample size estimation, and the criteria for inclusion and exclusion of any data or subjects).

All datasets, program code, and methods used in your manuscript must be appropriately cited in the text and listed in the references section, either in the form of the publications in which they were first reported or in the form of independent persistent identifiers such as the DOI. When a dataset, program code, or method has a persistent identifier independent from the original study in which it was first reported, we encourage you to cite both that identifier and the original study. For details on how references should be presented, please see the references section on the journal's information for authors page.

## QUANTIFICATION AND STATISTICAL ANALYSIS

**Please omit this section if your study does not include statistical analysis or quantification.*

Please describe all the statistical analysis and software used. We ask authors to indicate where all of the statistical details of experiments can be found (e.g., in the figure legends, figures, results, etc.), including the statistical tests used, exact value of *n*, what *n* represents (e.g., number of animals, number of devices, number of cells, number of times a chemical reaction was run, etc.), definition of center, and dispersion and precision measures (e.g., mean, median, SD, SEM, confidence intervals). Also please summarize how significance was defined, the statistical methods used to determine strategies for randomization and/or stratification, sample size estimation, and inclusion and exclusion of any data or subjects, as well as any methods used to determine whether the data met assumptions of the statistical approach.

## ADDITIONAL RESOURCES

**Please omit this section if your study has not generated or contributed to a new website/forum or if it is not part of a clinical trial.*

Please provide links to websites that provide further information relevant to the study (e.g., protocol download, troubleshooting forum, etc.). Clinical trial registry numbers and links should also be placed here. Please briefly describe the resource and its relevance for the paper. Please report this information as:

"*Description: URL*"

### KEY RESOURCES TABLE

The key resources table (KRT) serves to highlight materials and resources (including starting materials needed for synthesis, genetically modified organisms and strains, cell lines, reagents, software, experimental models, and original source data for computational studies) essential to reproduce results presented in the manuscript. The items in the table must also be reported alongside the description of their use in the method details section. Literature cited within the KRT must be included in the references list. We highly recommend using RRIDs as the identifiers for antibodies and model organisms.

***Please do not add custom headings or subheadings to the KRT.***

To create the table, please use the provided table template or the KRT webform.

## II. STAR Methods final files checklist

When submitting your article, please provide materials in the formats shown below.

- **Main document file:** *Word or LaTeX document, including (in this order):*
  - Standard article sections (as applicable)
    (title, authors and affiliations, summary, introduction, results, discussion, resource availability, acknowledgments, author contributions, declaration of interests)
  - Main figure titles and legends
  - Main tables and corresponding titles and legends (if applicable)
  - STAR Methods text
  - Supplemental item titles (including "related to" info; mandatory) and legends (optional) for items that are not included in the main supplemental PDF (if applicable) (e.g., Excel tables, supplemental movies, etc.)
  - References (all main text references, including those cited only in the KRT and STAR Methods text, should appear in one references list. Supplemental references should appear in the supplemental PDF. Additional information is available in the supplemental information guidelines.)

- **Key resources table:** *separate Word document created from table template or KRT webform.*

- **Main figures or schemes:** *individual TIFF or PDF files*
  (TIFF is preferred format; see figure guidelines for additional specs)

- **Supplemental figures with corresponding titles and legends and supplemental tables with corresponding titles and legends** (non-Excel/CSV): *combined in one PDF file*
  - See supplemental information guidelines for additional details
  - Titles should include "related to" info; legends are mandatory for supplemental figures but optional for supplemental tables

- **Supplemental tables not included in the main supplemental PDF**: *Excel or CSV*
  - Descriptive table titles (mandatory) and legends (optional) should be included *in the main document file after the STAR Methods text*
  - Titles should include "related to" info

- **Supplemental movie and/or data files**
    - See supplemental information guidelines for preferred file formats
    - Descriptive titles (including "related to" info; mandatory) and legends (optional) should be included *in the main document file (after the STAR Methods text)*

## III. STAR Methods reference sheet

This list highlights key points that should be followed to ensure timely acceptance of the manuscript.

**GENERAL FORMAT REQUIREMENTS**

1. Are there no more than two levels of customized subheadings to help organize the information reported in the STAR Methods text?
2. Are the subheadings shorter than 45 characters and free of numbering?
3. Is sufficient information provided about the methods and analyses so that readers understand how experiments and analyses were conducted and/or modified if based on previously published work?
4. Are the references cited in the STAR Methods text and key resources table provided in the main references list?

**EXPERIMENTAL MODEL AND STUDY PARTICIPANT DETAILS**

1. Are all experimental models (human, animal, plant, cell line, microbes) listed in this section under separate headings?
2. For **human studies**:
    a. Is there a statement identifying the committee approving the studies and confirming that informed consent was obtained from subjects?
    b. Are the sex, gender, ancestry, race, ethnicity, socioeconomic status, and age provided here for all study participants or is it indicated where they can be found? If not, is there a statement of why these data are unavailable, and is there a discussion of how the absence of these data limits the study's generalizability?
    c. Are the sample size and how subjects/samples were allocated to experimental groups specified?
    d. If sensitive human materials falling under ISSCR category 1a and 2 designations are used, is a specific ethics statement provided?
3. For **studies that work with live vertebrates**:
    a. Is the committee approving the experiments identified?
    b. Is there confirmation that all experiments conform to the relevant regulatory standards?
4. For **animal studies**, are the sex, genotype, age/developmental stage, health status, involvement in previous procedures, and other parameters following ARRIVE guidelines specified? If not, is there a statement of why these data are unavailable?
5. For **studies that include both male and female animal subjects or tissue from both sexes**, is an analysis of the influence (or association) of sex on the results of the study provided? If not, is there a statement of why such analyses were not performed? If these analyses were not performed, include a discussion of how their absence limits the study's generalization. Include negative results as well as results that show differences.
6. For **studies that involve human participants**, is an analysis of the influence (or association) of sex, gender, ancestry, race and ethnicity, socioeconomic status, or a combination of these factors on the results of the study provided? If not, is there a statement of why such analyses were not performed? If these analyses were not performed, include a discussion of how their absence limits the study's generalization. Include negative results as well as results that show differences.

7. For **animal studies**, are housing and husbandry conditions specified?
8. For **plant studies:**
    a. Is information provided on how seeds were surface sterilized, stratified, germinated, and vernalized, if applicable? Are details of solutions or media used for these steps, temperatures, and lengths of time included?
    b. Are growth conditions, including details of culture chamber makes and models, temperatures, times and light intensities of illumination, artificial lighting periods for greenhouses, substrate composition, fertilizer application regimes (if applicable), and humidity, specified?
9. For ***in vitro* studies**, including expression systems for source material, are culture conditions/maintenance specified?
10. For **cell lines and primary cultures of animal origin**, is the sex reported? If not, is there a statement of why these data are unavailable and a discussion as to how their absence might limit the study's generalizability?
11. For **cell lines and primary cultures of human origin**, are the sex and gender reported? If not, is there a statement of why these data are unavailable and a discussion as to how their absence might limit the study's generalizability?
12. Is any available information on **cell line authentication** provided?

## METHOD DETAILS

1. Are method-specific descriptive subheadings provided (must be less than 45 characters and not numbered)?
2. Is there detailed information on the methods such that it is clear how and why procedures or analysis were conducted?
3. Are the methods provided in full, instead of referring to other papers for details?
4. For experiments in which temperature may impact results (e.g., electrophysiology, behavior of subjects or materials, binding assays, chemical reactions, materials synthesis or characterization), is the temperature provided?
5. Are the references cited provided in the references list?
6. Is there information related to **experimental design**?
    a. Replication
    b. Strategy for randomization and/or stratification
    c. Whether the study was done blinded
    d. Inclusion and exclusion criteria of any data or subjects
    e. Sample size estimation and statistical method of computation

## QUANTIFICATION AND STATISTICAL ANALYSIS

1. Is there an explanation of the statistical analysis used to quantify data?
2. Is there a statement of where the statistical parameters (i.e., exact value of *n*, what *n* represents, SEM, SD, etc.) are reported in the paper?
3. Is there a statement of whether any methods were used to determine whether the data met assumptions of the statistical approach?

## ADDITIONAL RESOURCES

1. If there are websites or resources (i.e., protocol site, forum) that have been created or further expanded by this study to provide additional information or support relevant to the paper, are the information and links reported?
2. If relevant, are the **clinical registry numbers** and links associated with study provided?

**KEY RESOURCES TABLE (KRT)**

1. Have custom headings or subheadings been added? (This is prohibited.)
2. Are all of the items in the KRT also mentioned in the method details or main text of the manuscript?
3. Are all of the papers that are cited in the KRT included in the references list?
4. Are the source and identifier provided for all resources, if available? (If an identifier is not available, “N/A” should appear in the column.)
5. Are the unique identifiers provided for all items listed and clearly labeled (e.g., prepended with Cat#, Lot, Clone, RRID, GEO)? Please see the table template for examples.
6. Are all standardized data types used or generated in the study included and provided with accession numbers?
7. Is all original code included and provided with a DOI?
8. Is all published code used in the study included with a DOI or a reference to the original paper?
9. When more than 10 oligonucleotides or RNA sequences are used, are they provided in a supplemental table and cited in the KRT?
10. Is there only one item per row?
11. Are the descriptions for the items intuitive and informative?